CLAIMS

1. A downhole electric motor having at least three phases and comprising a permanent magnet rotor and a stator bearing phase windings (A, B and C) in slots (2206) in the stator, each phase winding (A, B, C) incorporating a plurality of coils each extending through a respective pair of closed stator slots (2206) and surrounding a respective portion of the stator between said stator slots (2206), and adjacent coils of different phases extending through opposite parts of a respective one of the stator slots (2206).

2. A motor according to claim 1, wherein said adjacent coils are separated by a gap through which cooling fluid may be pumped to cool the coils.

3. A motor according to claim 1, wherein said adjacent coils are separated by a thermally conductive projection (3110), with which the coils are in thermal contact, extending at least part of the way across the slot (2206).

4. A motor according to claim 1, 2 or 3, wherein the stator incorporates nine windings (A, B, C) extending through nine slots (2206) and consisting of three windings for each phase.

5. A motor according to claim 1, 2 or 3, wherein the stator incorporates twelve windings (A, B, C) extending through twelve slots (2206) and consisting of four windings for each phase.

6. A downhole electric motor having a rotor and a stator bearing phase windings (A, B, C) in slots in the stator, the stator being made up of first and second concentric parts (2207, 2208) which together define the slots (2206) in the stator so as to permit the phase windings (A, B, C) to be fitted to the first part (2207) prior to fitting of the second part (2208) to enclose the phase windings (A, B, C) within the slots (2206), wherein a projection (3110) is provided on one of the concentric parts (2207, 2208) for extending

at least part of the way across one of the slots (2206) to separate adjacent windings within the slot.

7. A downhole electric motor having a rotor and a stator bearing phase windings (A, B, C) in slots in the stator, the stator being made up of first and second concentric parts (2207, 2208) which together define the slots (2206) in the stator so as to permit the prefabricated phase windings (A, B, C) to be fitted to the first part (2207) prior to fitting of the second part (2208) to enclose the phase windings (A, B, C) within the slots (2206), wherein the slots (2206) are substantially shaped to conform to the cross-section of the phase windings (A, B, C) in order to provide close thermal contact and mechanical support between the phase windings (A, B, C) and the surrounding material of the stator.

8. A downhole electric motor having a rotor and a stator bearing phase windings (A, B, C) in slots in the stator, the stator being made up of first and second concentric parts (2207, 2208) which together define the slots (2206) in the stator so as to permit the prefabricated phase windings (A, B, C) to be fitted to the first part (2207) prior to fitting of the second part (2208) to enclose the phase windings (A, B, C) within the slots (2206), wherein at least one of the concentric parts (2207, 2208) comprises a preassembled stack of laminations to which the other of the concentric parts (2207, 2208) is fitted to enclose the phase windings (A, B, C) within the slots (2206).

9. A downhole electric motor having a rotor and a stator bearing phase windings (A, B, C) in slots in the stator, the stator being made up of first and second concentric parts (2207, 2208) which together define the slots (2206) in the stator so as to permit the prefabricated phase windings (A, B, C) to be fitted to the first part (2207) prior to fitting of the second part (2208) to enclose the phase windings (A, B, C) within the slots (2206), wherein at least one of the concentric parts (2207, 2208) is cast from insulated ferromagnetic powder and is fitted to the other of the concentric parts (2207, 2208) to enclose the phase windings (A, B, C) within the slots (2206).

10. A motor according to claim 9, wherein said at least one of the concentric parts (2207, 2208) comprises a plurality of cast arcuate segments.

11. A motor according to any one of claims 6 to 10, wherein the stator comprises a stack of laminations extending transversely of an axis of rotation of the motor, each lamination comprising a first portion incorporated in the first part (2207) of the stator and a second portion incorporated in the second part (2208) of the stator.

12. A motor according to any one of claims 6 to 11, wherein the first part (2207) of the stator comprises an inner cylindrical member having slots in its outer surface separated by lands and the second part (2208) of the stator comprises an outer annular member that surrounds the first part (2207) such that portions of an inner surface of the second part (2208) engage outer portions of the lands of the first part (2207).

13. A method of constructing a downhole electric motor having a rotor and a stator bearing phase windings (A, B, C) in slots (2206) in the stator, the method comprising the steps of fitting phase windings (A, B, C) to a first part (2207) of the stator, and combining the first part (2207) with a second part (2208) of the stator concentric with the first part (2207) so as to enclose the windings (A, B, C) within slots, a projection (3110) on one of the concentric parts (2207, 2208) extending at least part of the way across one of the slots (2206) to separate adjacent windings within the slot when the first part (2207) is combined with the second part (2208).

14. A method of constructing a downhole electric motor having a rotor and a stator bearing phase windings (A, B, C) in slots (2206) in the stator, the method comprising the steps of fitting phase windings (A, B, C) preassembled with an outer layer of insulating material to a first part (2207) of the stator, and combining the first part (2207) with a second part (2208) of the stator concentric with the first part (2207) so as to enclose the windings (A, B, C) within slots with the outer layer of insulating material serving to insulate the windings (A, B, C) from the surrounding material of the stator.

15. A method according to claim 14, wherein a projection (3110) on one of the concentric parts (2207, 2208) extends at least part of the way across one of the slots (2206) to separate adjacent windings within the slot when the first part (2207) is combined with the second part (2208).

16. A method according to claim 13, 14 or 15, which includes the further step of inserting the first and second parts (2207, 2208) of the stator with the windings (A, B, C) fitted thereto into a housing prior to insertion of the permanent magnet rotor.

17. A method according to any one of claims 13 to 16, wherein laminations of the stator are rotationally aligned by means of features on an alignment tool or inserts mounted thereupon.

18. A method according to any one of claims 13 to 17, wherein the first and second parts (2207, 2208) of the stator are connected together by compression.

19. A method according to any one of claims 13 to 18, wherein the windings (A, B, C) are preformed before being fitted to the first part (2207) of the stator.

20. A method according to any one of claims 13 to 19, further comprising the step of grinding the stator on the outside diameter.

21. A downhole electric motor having a first multiple-phase section (3001) and a second multiple-phase section (3001') and separate supply leads (110, 110') for supplying said first and second sections (3001, 3001') with electrical power from the surface.

22. A motor according to claim 21, wherein the first and second sections (3001, 3001') comprise two sets of phase windings wound on a common stator such that the motor may be driven by supply of power to only one of the sections (3001, 3001') in the event of failure of power to the other section.

23. A motor according to claim 22, wherein the first section comprises a first set of phase windings (300) wound on a first motor stator and the second section comprises a second set of phase windings (3001') wound on a second motor stator with common rotor or mechanically coupled rotors.

24. A method of constructing a downhole electric motor having a rotor and a stator bearing phase coils (A, B, C) in slots (2206) in the stator, the method comprising the steps of fitting open ended conductive loops within the slots in the stator, and closing the conductive loops to form the phase coils.

25. A method according to claim 24, wherein an insulating layer is provided on side surfaces of the conductive loops.

26. A permanent magnet motor having a rotor provided with permanent magnet means (204), and a stator coaxial with the rotor, wherein the permanent magnet means (204) is provided with an anti-corrosion coating.